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WATER QUALITY CONTROL STUDY; AMERICAN RIVER - TAHOE BASIN DIVERSIONS CALIFORNIA, A PRELIMINARY EVALUATION OF EFFECTS ON WATER QUALITY AND WATER USE

Public Health Service
San Francisco, California

May 1964

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WATER QUALITY CONTROL STUDY

AMERICAN RIVER - TAHOE BASIN DIVERSIONS CALIFORNIA

A Preliminary Evaluation of Effects on Water Quality and Water Use

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region IX
San Francisco, California

May, 1964

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WATER QUALITY CONTROL STUDY

AMERICAN RIVER - TAHOE BASIN DIVERSIONS
CALIFORNIA

A Preliminary Evaluation of
Effects on Water Quality and Water Use

Prepared at the request of

DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

by

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region IX
San Francisco, California

May, 1964

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INTRODUCTION

Authority and Request

The Bureau of Reclamation, in a letter dated October 24, 1963, requested that the Public Health Service prepare a report on the effects on water quality and water uses of the proposed Tahoe Diversion schemes.

The study has been made in accordance with the Federal Water Pollution Control Act (Public Law 84-660) as amended by Public Law 87-88.

Purpose

The purpose of this study is to present the results of a preliminary evaluation of the effects on water quality and water users resulting from proposed U. S. Bureau of Reclamation diversion schemes which would transport water from the upper reaches of the American River to the Lake Tahoe - Truckee River Basin.

Scope

This study is limited to a preliminary analysis of available information collected from county, state, and federal agencies. The study area lies in California and Nevada and includes the Upper Reaches of the American River Basin, the Tahoe Basin, and the Upper Reaches of the Truckee River Basin. There was no field work involved in the study nor was a visit made to the proposed sites due to the necessity of completing this report while much of the area was under snow. The public health, water pollution, and water quality aspects of the proposed exportation of sewage effluent from the Tahoe Basin are not within the scope of this study.

Acknowledgments

Valuable assistance and data for this study were provided by personnel of the following agencies:

U. S. Department of Interior, Bureau of Reclamation, Region 2
Sacramento, California

California State Department of Water Resources, Water Quality Section

California State Health Department, Bureau of Sanitary Engineering

El Dorado County Health Department

Placer County Health Department

The cooperation, data and assistance furnished by these agencies is sincerely appreciated.

SUMMARY OF FINDINGS

1. There will be a future need for additional water resource development in the Lake Tahoe Basin. The Bureau of Reclamation projects a need in 2010 that varies from a minimum of 2,400 to a maximum of 30,000 acre feet/year depending on the extent of sewage exported from the basin.

2. Local and state agencies fear that the increased quantity of nutrient entering the lake will result in algae blooms that could adversely affect Lake Tahoe's exceptional clarity and the export of sewage effluent is being considered as a means of minimizing this nutrient in-flow.

3. The Bureau of Reclamation is studying four schemes to divert water from the upper reaches of the American River through tunnels to the Tahoe - Truckee Basin and one plan to stop an existing diversion from the Tahoe to the American River Basin. Minimum fishery flows (as requested by the U. S. Fish and Wildlife Service) will be provided below the diversion points so most of the water diverted would be either flood flows or water impounded in existing lakes and presently used for power production.

4. There are no significant waste discharges to waters in the upper reaches of the American River and none are expected in the future.

5. There is current recreational use of the three lakes (Echo, Silver, and Twin Lake) involved in these schemes and significant withdrawal use from the South Fork of the American River.

CONCLUSIONS

1. North Fork American River - There are no apparent adverse effects which would occur to water quality or water users from this diversion scheme.

2. Rubicon River - There are no apparent adverse effects on water quality from this diversion and the only downstream detriment would be to power production.

3. Echo Lake - This plan would have no effect on current development about Echo Lake but it would be detrimental to existing power production. It should be determined whether the stopping of the present diversion would be detrimental to persons presently withdrawing from the upper reaches of the South Fork before going ahead with this plan.

4. Twin Lakes and Silver Lake - The proposed diversion plans are not likely to affect users about the lakes or in the Silver Fork. The plans would divert water presently used for municipal and industrial supply, irrigation, and power and the effect of depletions on all present and future users should be analyzed before going ahead with either of these plans.

5. The average nutrient concentration (total nitrogen and phosphorous) of all sources which may be diverted into the Tahoe Basin should be determined prior to recommending a particular plan so that the nutrient load transported into the Tahoe Basin can be minimized.

DESCRIPTION OF THE STUDY AREA

General

The study area includes the Lake Tahoe Basin, the upper reaches of the American River Basin, and the Truckee River Basin. (See Figure 1, page 14.)

The Tahoe Basin is about 506 square miles in area, including the 192 square mile surface area of Lake Tahoe. Approximately one-third of the basin area lies in Nevada and two-thirds in California. The lake is the second largest alpine lake in the world and its water is a beautiful blue color with exceptional clarity. A small dam at the north end of the lake controls the top six feet (maximum elevation of 6229) of the lake as a storage reservoir for downstream releases to the Truckee River. Average annual runoff to the Tahoe Basin is about 513,000 acre feet of which 332,000 is lost by evaporation and an average of 176,000 is discharged to the Truckee River.

The American River Basin is tributary to the Sacramento River and drains an area of 1958 square miles on the western slope of the Sierra Nevada mountains. Elevation of the drainage area varies from over 9,000 feet at the Tahoe Basin Divide to a few feet above sea level at Sacramento. Folsom Reservoir (1.0 million acre feet capacity) controls runoff from 1863 square miles. The average annual runoff is about 2.7 million acre feet at the dam.

The Truckee River Basin is pertinent to the study area because existing water rights require releases of large quantities of water from Lake Tahoe. The Truckee River originates at Lake Tahoe and flows for 106 miles through Reno, Nevada and terminates at Pyramid Lake. Primary use of the water is for irrigation and hydropower.

Economy

The present (and projected) economy of the Tahoe Basin is dependent on recreation, specifically legalized gambling and outdoor recreation. The basin had an estimated peak summer month population of 132,000 in 1962 and this has been projected to rise to 596,000 in 2010 (1).

The economy of the upper reaches of the American River is largely dependent on recreational activity that is oriented toward fishing, hiking, summer camps, and private cabins. Most of the present population (about 5,000) is located along streams and in close proximity to either U. S. Highway 50 (along the South Fork of

American River), or U. S. Highway 40 (near the North Fork of American River). Most of this area is National Forest land and it is unlikely that the nature of the economy or extent of development will change drastically. Significant suburban development is expected to occur in the lower reaches of the American River Basin as a result of growth of the Sacramento metropolitan area and this will probably result in increased day-time recreation use of the project area.

The Problem

Water resources in the Lake Tahoe Basin (see Figure 1) are not sufficient to maintain the water level in the lake and to fulfill both the projected consumptive use in the basin and existing water rights in the Truckee River. The Bureau of Reclamation projects that an additional 2400 acre feet/year (consumptive use) would be needed if all sewage effluent is kept in the Truckee River Basin but if most of the sewage is exported, the demand may be as high as 30,000 acre feet/year. The consideration of exporting sewage has resulted from a recent report which concluded that the large quantity of nutrients (nitrogen in particular) which would enter Lake Tahoe if future sewage discharges remain in the basin could result in algae blooms that would markedly affect the lake's exceptional clarity. A California - Nevada governors conference on November 11, 1963, concerning pollution of Lake Tahoe make recommendations on "Programs for Progress" that included: the south end of Lake Tahoe export treated sewage from the basin by the Fall of 1965; the north end of the lake study plans for exporting sewage; and that studies be conducted on acquisition of a water supply to replace exported sewage if and when required. The construction grants program of the U.S. Public Health Service recently awarded a grant to the South Tahoe Public Utility District (which currently has problems from overloading its spray disposal area) for part of the construction cost of a tertiary treatment plant and this grant is conditional on sewage being exported from the basin by Fall of 1965.

The Bureau of Reclamation is studying five diversion schemes on the upper reaches of the American River Basin to determine the most feasible manner of meeting the projected water need. It is not planned to recommend a particular diversion scheme until the problem of sewage export (and, therefore, the amount of water development needed) is resolved. The following construction and operating criteria are being used in analyzing these diversion plans: (1) diverted water will not be pumped, therefore tunnels will be necessary; (2) fish flows requested by the U. S. Fish and Wildlife Service will be met; (3) water will not be diverted in years when Lake Tahoe is spilling; and (4) the maximum tunnel capacity will be 350 cubic feet per second (cfs).

DESCRIPTION OF PROPOSED PROJECT

The proposed diversion plans are discussed below, with a description of present conditions of habitation, water use, and waste disposal. Water quality considerations are discussed later.

North Fork American River

A diversion dam at about elevation 6120 feet would divert an average of 5,600 acre feet/year via tunnel (Soda Springs Tunnel) to Donner Lake. This water would fulfill part of the Truckee River Basin water rights and thereby reduce mandatory releases from Lake Tahoe. Releases from Donner Lake go to Donner Creek and the Truckee River and are controlled by Sierra Pacific Power Company.

The requested fishery release at the diversion dam is 5 cfs year-round or the natural flow (whichever is less). There is usually less than 5 cfs in the streams during the summer months and if the proposed diversion scheme had been in effect during the period from 1922-52 there would have been diversions during July in only 6 years and none during August through October. Ninety five percent of all water diverted would have been in the months of March through June.

There is no known withdrawal use of water in this reach of the North Fork. There are summer home developments on two tributary streams (The Cedars on Cedar Creek and Sierra Ice Lakes on Serena Creek) and there is a camp ground on Onion Creek within a 5 mile radius of the diversion point. The Cedars withdraws water from Cedar Creek and sewage disposal is by septic tank. Sierra Ice Lakes gets plant and disposal to land. At the present time, there is no significant pollution of any of these creeks. All three creeks join the North Fork below the diversion point so that they would not affect the quantity or quality of water diverted. Downstream from Serena Creek, the North Fork traverses very rough country and is accessible only to hikers. It does not appear that any local water shortage problems would result from the proposed diversion.

Rubicon River

The Sacramento Municipal Utility District is presently constructing a diversion dam near Rubicon Springs and this scheme proposes to also divert water from the dam through a tunnel (Rubicon - Meeks Tunnel) to Meeks Creek in the Tahoe Basin. This diversion would

have an average annual yield of 35,000 acre feet/year which would satisfy the ultimate needs (projected by the Bureau of Reclamation) in the Tahoe Basin even if all of its sewage is exported. Fishery releases would be 6 cfs year-around or the natural flow (whichever is less). The proposed diversion scheme would divert about 80% of the water in April - June and less than 1% in August - October.

There is no development within 5 miles or the diversion site and none is contemplated since it is planned to maintain much of this area in the Desolation Valley Wilderness Area which will be unimproved. The area has hiking trails so there is limited public access. The provision of fishery flows would provide enough water to meet any anticipated downstream use.

Echo Lake

This lake is located in the Tahoe Basin but there is, presently, a diversion by the Pacific Gas and Electric Company (PG&E) to the American River Basin. The proposed plan would yield 1100 acre feet/ year by retaining this water in the Tahoe Basin.

There is an extensive summer home and resort development on the lake with a present peak summertime propulation of 1,000 - 1,500 is largely on an individual basis, with withdrawal, either from the lake or from shallow wells along the shore. Sewage disposal is mostly by septic tank. The proposed diversion would have no effect on residents of the lake since it is no more than is presently released.

The water is usually released to the South Fork in September through November and during September comprises about 11% (7 year average) of the water available to the El Dorado Ditch. This loss of water would be a detriment to either PG&E (who owns the ditch and uses much of the water for power generation) or to the El Dorado Irrigation District (EDID) which purchases water from PG&E for municipal and industrial (M&I) and agricultural use. Also, the September releases from Echo Lake provide virtually all of the water in the South Fork above Pyramid Creek and would comprise 15-50% of the flow in the South Fork, between Pyramid Creek and the confluence of the Silver Fork. There are many individuals and some small communities who depend on this reach of the river for their water supply and it is possible that the stopping of this release would be detrimental to some of them. The fishery could also be adversely affected by this reduced flow.

Twin Lakes

This proposed scheme would divert 11,400 acre feet/year from this lake through a tunnel (Twin Lakes Tunnel) to the Upper Truckee River in the Tahoe Basin. This Lake has a maximum storage capacity of 21,580 feet and is regulated by PG&E. Release go to Caples Creek which is a tributary of the Silver Fork. The requested fishery release is 15 cfs or the historical regulated flow (whichever is less). Flows below 15 cfs occur virtually every year and (due to the release schedule) these deficits occur most often between February and May.

Approximately 15 summer cabins and one Boy Scout Camp are located along the shores of the lake. Water is withdrawn from the lake by individuals and disposal is by septic tank or pit privy. Limited bacteriological data indicate that there is little or no pollution in the lake.

Downstream water uses are dicussed below for both Twin Lakes and Silver Lake.

Silver Lake and Twin Lakes

This plan would use three diversion dams to divert water from Silver Fork, Caples Creek and a third creek tributary to Caples Creek to the Upper Truckee River via a Sierra tunnel. Silver Lake has a storage capacity of 11,800 acre feet and is also regulated by PG&E. This scheme would divert an average of 30,000 acre feet/year from the 3 creeks after providing fish releases of 30 cfs (or historical flow). Deficits in fish flows would be the same as under the Twin Lakes scheme.

Twenty five or thirty summer cabins and a Boy Scout Camp are located on the lake shores. PG&E is said to be considering an extensive recreational development on the lake. Water supplies are taken individually from the lake and sewage disposal is by septic tank or pit privy. There are no significant pollution problems at this time.

The only known withdrawal user on the Silver Fork is the community of Silver Fork (located at the confluence with the South Fork) which receives its domestic supply from the river. Recreational fishing is heavy on both Silver Fork and Caples Creek. The El Dorado Ditch has its intake in the South Fork only a few hundred yards below the confluence and Silver - Twin Lake releases provide at least one-third of the water available to the ditch in August and September. Thus, either of these schemes (as does the Echo Lake scheme) would result in a detriment to PG&E's power operations or to the EDID users.

The schemes affecting the South Fork differ from the others in two ways: (1) there are immediate downstream users; and (2) much of the flow would be diverted during the dry season when the need is greatest. Extensive population growth in the EDID service area is likely to occur and its M&I needs could increase by 20,000 - 30,000 acre feet/year in the next 50 years. It is necessary that the projected water needs and the availability of alternate sources of supply for all users on the South Fork upstream from Placerville be analyzed prior to adopting any of these schemes to insure that the diversion will not result in future water storages.

WATER QUALITY

General Considerations

Water quality could be changed (benefically or detrimentally) by a diversion and the changes could occur both downstream from the diversion and in the receiving body of water. The major factor causing quality changes is the mixing of different quality waters. A reduction in the quantity of flow may also affect downstream users since there is less water available for use. Changes in either quality or quantity of water could affect public health, municipal and industrial users, agricultural uses, power development, fishery interests, and the waste assimilation capacity of the stream.

Effect of the Project

Many of the physical and chemical water quality parameters appear to be of no concern since limited data indicates that all of the streams have water of a very high quality (the total dissolved solids concentration ranges between 12 and 55 mg/l) and in general the effect on receiving waters will be negligible. The special cases of nutrient concentration, bacterilogical and viral contamination, and flow reduction deserves further comment. Since there are no waste discharges in the affected reaches of the streams, waste assimilation capacity and dissolved oxygen concentrations do not appear to be problems.

Nutrients

Any nutrients contained in water transported into the Tahoe Basin will increase the "nutrient load" applied to the basin. Results of 20 samples (taken in all seasons of the year) from below Silver and Twin Lakes indicate that the average nitrate nitrogen concentration might be about 0.07 milligrams per liter (as nitrogen) which is 2-3 times that reported for Tahoe Basin streams. This concentration would add 6,260 pounds/year to the Tahoe Basin if the Silver Lake and Twin Lakes scheme was used. The total nitrogen concentration might be much more than this (a recent report (1) states that in Tahoe Basin streams the nitrate nitrogen averaged only 7-12% of the total nitrogen). A single analysis from Echo Lake reported no detectable nitrates and there were no data available for the other diversions points. Phosphorus concentrations were not available for any of the locations.

The Lake Tahoe Waste Disposal Study (1) estimated that 530,000 pounds/year of nitrogen would reach the lake from precipitation and

urban and rural runoff even if all sewage and refuse were removed from the basin. The increment from nitrates in the Silver and Twin Lakes scheme would increase this by 1.2% and the total nitrogen might add 10% to the projected load (the quantity diverted would be about 6% of the runoff and precipitation reaching the lake). The quantity of nutrients reaching the lake would depend on the fate of this water in the Tahoe Basin since much of it could be diverted for M&I use and the waste transported out of the basin.

This small increment may or may not be critical but since the exact concentration which would be critical in Lake Tahoe is unkown any increment must be considered undesirable. However, if water must be imported, the American River sources are probably as low in nitrogen as any feasible supply. The average annual total nitrogen and phosphorous content at all proposed diversion points should be determined before adopting a particular plan since it cannot be assumed that all sources will have approximately equal concentrations. Since pollution can drastically increase the nitrogen concentration it would be desirable to routinely monitor water at any point where it is being diverted. particularly if there is significant human habitation in the vicinity.

Bacteriological and Viral Contamination

None of these diverted waters can be assumed to be "protected" sources ince there is access to all of the watersheds and in the cases of Echo, Silver, and Twin Lakes, there is a significant habitattion in the immediate vicinity. It is recognized that domestic water supply is not a part of this project but it should be mentioned that any of these waters should receive a minimum treatment of chlorination prior to domestic use and survey by local health agencies may indicate that more extensive treatment is necessary.

Flow Reduction

It has been mentioned that a reduced flow would affect hydroelectric power generation and might affect M&I and agricultural users. Any effect would probably be due to lack of quantity since quality is not likely to be changed. Some small users above the Silver Fork could be foreced to other supplies, but these supplies (if available) would probably be as protected from bacteriological contamination as the present ones. The most likely affect would be economic, that is the cost of developing another supply or of providing additional facilities to store some of the early summer flows.

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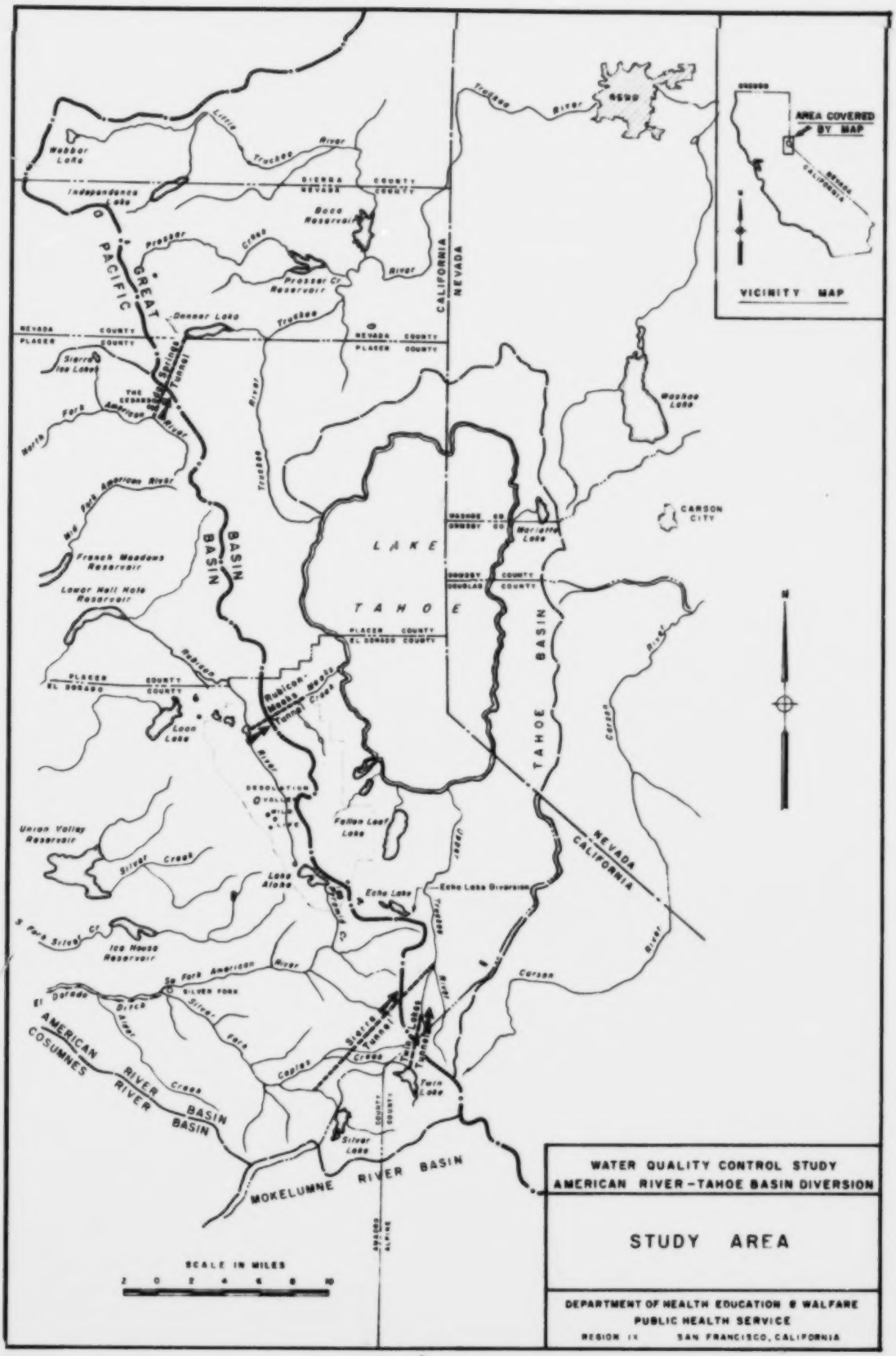
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VICINITY MAP
LAKE TAHOE
TAHOE BASIN
CARSON CITY
NEVADA
CALIFORNIA
GREAT BASIN
AMERICAN RIVER BASIN
COSUMNES RIVER BASIN
MOKELUMNE RIVER BASIN
Webber Lake
Donner Lake
Boca Reservoir
Prosser Cr. Reservoir
Sierra Tunnel
French Meadows Reservoir
Lower Hell Hole Reservoir
Loon Lake
Union Valley Reservoir
Ice House Reservoir
Echo Lake
Echo Lake Diversion
Fallen Leaf Lake
Lake Aloha
Silver Lake
Twin Lakes
Meiss Lake
Marlette Lake
Washoe Lake
Truckee River
Carson River
SCALE IN MILES
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